UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/849,927	05/04/2001	John E. Hudson	476-1890.1	8948

7590 04/05/2006

William M. Lee, Jr.
Lee, Mann, Smith, McWilliams, Sweeney & Ohlson
P.O. Box 2786
Chicago, IL 60690-2786

EXAMINER	
PATHAK, SUDHANSHU C	
ART UNIT	PAPER NUMBER
2611	

DATE MAILED: 04/05/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

UNITED STATES PATENT AND TRADEMARK OFFICE

Commissioner for Patents
United States Patent and Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450
www.uspto.gov

BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application Number: 09/849,927
Filing Date: May 04, 2001
Appellant(s): HUDSON, JOHN E.

William M. Lee, Jr.
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed on January 9th, 2006 appealing from the Office action mailed June 28th, 2005.

(1) Real Party in Interest

A statement identifying the real part in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

Applicant Admitted Prior Art (AAPA)

4, 141, 072	Perreault	02-1979
4, 707, 841	Yen et al.	11-1987

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

1. Claims 1-2, 4, 6-14, 16, 19-21, 23-27 & 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over the Applicant Admitted Prior Art (AAPA) in view of DiToro (4,058,713).

Regarding to Claims 1, 8-13, 16, 19, 25, 26-27 & 29, the Applicant Admitted Prior Art (AAPA) discloses a wireless communications system comprising transceivers (cellular base station and subscriber handsets) for transmitting/receiving data (Specification, Page 2, lines 2-28). The AAPA also discloses implementing a downlink transmit diversity antennas (transmitting over a plurality of transmit antenna elements) to address fading and coloring of a channel through the use of space-time transmit diversity (STTD) for non-dispersive channels (Specification, Page 2, lines 30-32 & Specification, Page 3, lines 1-8 & Specification, Page 7, lines 4-16). The AAPA also discloses the data stream is space-time coded (STC) (Specification, Page 2, lines 30-32 -to- Specification, Page 3, lines 1-8). The AAPA also discloses the communications system exhibits a frame structure containing a number of slots or packets wherein each packet is of a certain chips in length (Specification, Page 3, lines 19-25). The AAPA also discloses each packet containing at least one data portion(s) and at least one training sequence interspersed between the successive data portions (Specification, Page 3, lines 25-27). The AAPA also discloses

implementing the training sequence to determine a channel impulse response for the channel equalization purposes (Specification, Page 3, lines 30-32 & Specification, Page 4, lines 1-2). The AAPA also discloses data stream is arranged such that a code-word level construction of an STTD transmitted signal is modified to a chip-level construction in which CDMA code words are interleaved at a chip level instead of being transmitted whole in sequence (Specification, Page 3, lines 19-32 & Specification, Page 4, lines 1-12). However, the AAPA does not disclose generating via a fast transform a packet spectrum of at least a portion of the data stream, the packet spectrum being a transform domain representation; generating via a fast transform a channel impulse response spectrum in the transform domain for the channel impulse response; equalizing the packet spectrum with the channel impulse response spectrum to produce an equalized packet spectrum in the transform domain; and converting the equalized packet spectrum into time domain equalized data for recovery of information.

DiToro disclose generating via a fast transform a packet spectrum of at least a portion of the data stream, the packet spectrum being a transform domain representation; generating via a fast transform a channel impulse response spectrum in the transform domain for the channel impulse response; equalizing the packet spectrum with the channel impulse response spectrum to produce an equalized packet spectrum in the transform domain; and converting the equalized packet spectrum into time domain equalized data for recovery of information (Abstract, lines 1-6, 9-15 & Fig. 4, elements 41-42 & Fig. 6A-B & Fig. 7A-J & Column

2, lines 7-40 & Column 4, lines 10-39 & Column 5, lines 1-12 & Column 7, lines 5-22 & Column 8, lines 4-63 & Column 9, lines 1-68 & Column 10, lines 1-58 & Claim 4). DiToro also discloses the fast transform to be a Fourier transform (Fig. 4, element 42 & Fig. 6A-B, elements 50a-c & Column 2, lines 1-4 & Column 4, lines 15-24). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention that DiToro teaches an equalization process implemented in the frequency domain and this is implemented in the receiver as described in the communication system as described in the AAPA so as to accurately recover the transmitted signal in the receiver by minimizing the computational complexity of the equalization process.

Regarding to Claims 2, 14 & 20, the AAPA in view of DiToro discloses a method of channel equalization comprising generating via a fast transform a packet spectrum of at least a portion of the data stream, the packet spectrum being a transform domain representation; generating via a fast transform a channel impulse response spectrum in the transform domain for the channel impulse response; equalizing the packet spectrum with the channel impulse response spectrum to produce an equalized packet spectrum in the transform domain; and converting the equalized packet spectrum into time domain equalized data for recovery of information as described above. DiToro further discloses equalizing the packet spectrum further comprising deconvolving transmitted and received data streams with respect to channel impulse response spectra, thereby to produce at least one equalized data stream (Column 1, lines 60-68 & Column 2, lines 1-4). Therefore, it

would have been obvious to one of ordinary skill in the art at the time of the invention that the AAPA in view of DiToro satisfies the limitation of the claim.

Regarding to Claims 4 & 21, the AAPA in view of DiToro discloses a method of channel equalization comprising generating via a fast transform a packet spectrum of at least a portion of the data stream, the packet spectrum being a transform domain representation; generating via a fast transform a channel impulse response spectrum in the transform domain for the channel impulse response; equalizing the packet spectrum with the channel impulse response spectrum to produce an equalized packet spectrum in the transform domain; and converting the equalized packet spectrum into time domain equalized data for recovery of information as described above. DiToro also discloses determining the length of the complex fourier coefficients depending on the precision of the receiver to which the receiver must be held and size of the associated memories and the coefficients can be varied to suit different requirements of accuracy (Column 4, lines 6-24 & Column 8, lines 38-46). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention that the AAPA in view of DiToro satisfies the limitations of the claim. Furthermore, even though DiToro does not disclose truncating the channel impulse response spectra to limit the processing, this is a matter of design choice and depending on the accuracy and cost desired, the truncating of the spectra is determined.

Regarding to Claims 6, 15 & 23, the AAPA in view of DiToro discloses a method of channel equalization comprising generating via a fast transform a packet

spectrum of at least a portion of the data stream, the packet spectrum being a transform domain representation; generating via a fast transform a channel impulse response spectrum in the transform domain for the channel impulse response; equalizing the packet spectrum with the channel impulse response spectrum to produce an equalized packet spectrum in the transform domain; and converting the equalized packet spectrum into time domain equalized data for recovery of information as described above. The AAPA also discloses assessing the channel impulse response for the channel based on the training sequence further includes assessing a matrix-valued channel impulse response (Specification, Page 7, lines 3-17). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention that the AAPA in view of DiToro satisfies the limitations of the claim.

Regarding to Claims 7 & 24, the AAPA in view of DiToro discloses a method of channel equalization comprising generating via a fast transform a packet spectrum of at least a portion of the data stream, the packet spectrum being a transform domain representation; generating via a fast transform a channel impulse response spectrum in the transform domain for the channel impulse response; equalizing the packet spectrum with the channel impulse response spectrum to produce an equalized packet spectrum in the transform domain; and converting the equalized packet spectrum into time domain equalized data for recovery of information as described above. The AAPA also discloses receiving the data stream at a plurality of receive antenna elements (Specification, Page 2, lines 30-32 & Specification,

Page 3, lines 1-8 & Specification, Page 6, lines 15-28). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention that the AAPA in view of DiToro satisfies the limitations of the claim.

2. Claims 3 & 28 are rejected under 35 U.S.C. 103(a) as being unpatentable over the Applicant Admitted Prior Art (AAPA) in view of DiToro (4,058,713) in further view of Perreault (4,141,072).

Regarding to Claim 3 & 28, the AAPA in view of DiToro discloses a method of channel equalization comprising generating via a fast transform a packet spectrum of at least a portion of the data stream wherein the data stream generated is a space time coded (STC) data stream, the packet spectrum being a transform domain representation; generating via a fast transform a channel impulse response spectrum in the transform domain for the channel impulse response; equalizing the packet spectrum with the channel impulse response spectrum to produce an equalized packet spectrum in the transform domain; and converting the equalized packet spectrum into time domain equalized data for recovery of information as described above. However, the AAPA in view of DiToro does not disclose equalizing the packet spectrum includes performing a minimum mean square error (MMSE) spectral ratio comparison.

Perreault discloses an automatic equalizer for calculating the equalization transfer function of the transmission channel and applying the same to equalize the received signals, furthermore the equalization coefficients are obtained using a mean square error criteria for convergence to the desired values (Abstract, lines 1-5

& Column 1, lines 50-55). Perreault also discloses providing a frequency domain representation of the received signals, adjusting the frequency domain representation then means for generating a time domain representation of the adjusted frequency domain representation (Column 2, lines 4-10). Perreault also discloses generating a correction signal associated with the minimum mean square error of said received signal and means for adjusting the frequency domain representation with the correction signal (Column 2, lines 12-27 & Column 5, lines 61-68 & Column 6, lines 1-12 & Fig. 5). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention that Perreault teaches implementing a frequency domain equalizer utilizing a minimum mean square error and this is implemented in the receiver as described in the communication system as described in the AAPA so as to provide a criteria for minimizing the error and accurately equalize the channel.

3. Claims 17 & 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over the Applicant Admitted Prior Art (AAPA) in view of DiToro (4,058,713) in further view of Yen et al. (4,707,841).

Regarding to Claim 17, the Applicant Admitted Prior Art (AAPA) discloses a wireless communications system comprising transceivers (cellular base station and subscriber handsets) for transmitting/receiving data (Specification, Page 2, lines 2-28). The AAPA also discloses implementing a downlink transmit diversity antennas (transmitting over a plurality of transmit antenna elements) to address fading and coloring of a channel through the use of space-time transmit diversity (STTD) for

non-dispersive channels (Specification, Page 2, lines 30-32 & Specification, Page 3, lines 1-8 & Specification, Page 7, lines 4-16). The AAPA also discloses the data stream is space-time coded (STC) (Specification, Page 2, lines 30-32 –to-Specification, Page 3, lines 1-8). The AAPA also discloses the communications system exhibits a frame structure containing a number of slots or packets wherein each packet is of a certain chips in length (Specification, Page 3, lines 19-25). The AAPA also discloses each packet containing at least one data portion(s) and at least one training sequence interspersed between the successive data portions (Specification, Page 3, lines 25-27). The AAPA also discloses implementing the training sequence to determine a channel impulse response for the channel equalization purposes (Specification, Page 3, lines 30-32 & Specification, Page 4, lines 1-2). The AAPA also discloses data stream is arranged such that a code-word level construction of an STTD transmitted signal is modified to a chip-level construction in which CDMA code words are interleaved at a chip level instead of being transmitted whole in sequence (Specification, Page 3, lines 19-32 & Specification, Page 4, lines 1-12). However, the AAPA does not disclose generating via a fast transform a packet spectrum of at least a portion of the data stream, the packet spectrum being a transform domain representation; generating via a fast transform a channel impulse response spectrum in the transform domain for the channel impulse response; equalizing the packet spectrum with the channel impulse response spectrum to produce an equalized packet spectrum in the transform

domain; and converting the equalized packet spectrum into time domain equalized data for recovery of information.

DiToro disclose generating via a fast transform a packet spectrum of at least a portion of the data stream, the packet spectrum being a transform domain representation; generating via a fast transform a channel impulse response spectrum in the transform domain for the channel impulse response; equalizing the packet spectrum with the channel impulse response spectrum to produce an equalized packet spectrum in the transform domain; and converting the equalized packet spectrum into time domain equalized data for recovery of information (Abstract, lines 1-6, 9-15 & Fig. 4, elements 41-42 & Fig. 6A-B & Fig. 7A-J & Column 2, lines 7-40 & Column 4, lines 10-39 & Column 5, lines 1-12 & Column 7, lines 5-22 & Column 8, lines 4-63 & Column 9, lines 1-68 & Column 10, lines 1-58 & Claim 4). DiToro also discloses the fast transform to be a Fourier transform (Fig. 4, element 42 & Fig. 6A-B, elements 50a-c & Column 2, lines 1-4 & Column 4, lines 15-24). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention that DiToro teaches an equalization process implemented in the frequency domain and this is implemented in the receiver as described in the communication system as described in the AAPA so as to accurately recover the transmitted signal in the receiver by minimizing the computational complexity of the equalization process. However, the AAPA in view of DiToro does not disclose an integrated chip having a controller programmed to provide a channel equalization function.

Yen discloses an integrated chip having a controller programmed to provide a channel equalization function (Fig. 1, elements 40, 48 & Column 1, lines 15-20 & Column 4, lines 17-25, 44-48 & Column 7, lines 59-65 & Column 8, lines 41-54). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention that Yen teaches implementing an equalizer in an integrated chip having a controller programmed to provide a channel equalization function, and is implemented in the equalizer as described in the communication system as described in AAPA in view of DiToro so as to provide a small, low cost and portable modem for data transmission, thus satisfying the limitation of the claim.

Regarding to Claim 18, the AAPA in view of DiToro in further view of Yen discloses a method of channel equalization comprising generating via a fast transform a packet spectrum of at least a portion of the data stream, the packet spectrum being a transform domain representation; generating via a fast transform a channel impulse response spectrum in the transform domain for the channel impulse response; equalizing the packet spectrum with the channel impulse response spectrum to produce an equalized packet spectrum in the transform domain; and converting the equalized packet spectrum into time domain equalized data for recovery of information implemented in an integrated chip having a controller programmed to provide channel equalization as described above. DiToro further discloses equalizing the packet spectrum further comprising deconvolving transmitted and received data streams with respect to channel impulse response spectra, thereby to produce at least one equalized data stream (Column 1, lines 60-

68 & Column 2, lines 1-4). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention that the AAPA in view of DiToro in further view of Yen satisfies the limitation of the claim.

(10) Response to Argument

In regards to the arguments presented, the AAPA discloses all the limitations of Claim 1 i.e. receiving a data stream generated from a plurality of transmit antenna elements; receiving a training sequence for a channel through which the data stream has been sent and determining the channel impulse response for the channel equalization purposes as disclosed above in the rejections. However, the AAPA does not disclose generating via a fast transform a packet spectrum of at least a portion of the data stream, the packet spectrum being a transform domain representation; generating via a fast transform a channel impulse response spectrum in the transform domain for the channel impulse response; equalizing the packet spectrum with the channel impulse response spectrum to produce an equalized packet spectrum in the transform domain; and converting the equalized packet spectrum into time domain equalized data for recovery of information i.e. performing the equalization in the frequency domain (spectrum) and then reconverting the signal in the time domain. This specific limitation is disclosed in the DiToro reference (4,058,713) as disclosed above in the rejections and is further admitted by the applicant in the Appeal Brief, Argument, Page 6, lines 1-5.

In Regard to the specific argument (Appeal Brief, Argument, Page 6, lines 5-8) that the DiToro reference "...does not disclose a method of equalizing a received

message signal where said signal is generated from a plurality of received data streams received from a plurality of transmit antenna elements and where said data streams are space time coded (STC) data streams...". The Office agrees with this assessment, however, this limitation is disclosed in the AAPA as disclosed in the rejection above. The AAPA discloses a wireless communications system comprising transceivers (cellular base station and subscriber handsets) for transmitting/receiving data (Specification, Page 2, lines 2-28). The AAPA also discloses implementing a downlink transmit diversity antennas (transmitting over a plurality of transmit antenna elements) (Specification, Page 2, lines 30-32 & Specification, Page 3, lines 1-8 & Specification, Page 7, lines 4-16). The AAPA also discloses the data stream is space-time coded (STC) (Specification, Page 2, lines 30-32 -to- Specification, Page 3, lines 1-8).

In regards to the specific argument(s) that (Appeal Brief, Argument, Page 7, lines 7-12) "The present invention therefore proposes using space time coding in a dispersive communications channel contrary to received wisdom in the field of STC and STTD in order to equalize a received signal. A skilled person would not seriously contemplate modifying the Applicant Admitted Prior Art (AAPA) which utilizes STC in a non-dispersive communications channel with the equalization method disclosed in DiToro for a number of reasons." and (Appeal Brief, Page 8, lines 23-26), that the "Examiner has never explained why a skill person would be motivated to apply the technique of ...STC and ....STTD implemented in the non-dispersive communications channel....to the dispersive communication of the DiToro

or vice-versa". In regards to the discussion regarding the type of communication channel (dispersive or non-dispersive), this limitation has not been claimed. The rejections of the claims were based on the recited (claimed) limitations. A channel is characterized, as a dispersive channel if it causes dispersion in the data that is transmitterd over it, however a channel is still dispersive if there are also non-dispersive interferences along with the dispersive interferences in the channel. Furthermore, the DiToro reference is used for the limitation of implementing the equalization in the receiver in the frequency domain and the communication systems in both the references are analogous i.e. wireless channel. The limitation of equalization in the frequency domain is indeed taught in the reference (Abstract, lines 1-6, 9-15 & Fig. 4, elements 41-42 & Fig. 6A-B & Fig. 7A-J & Column 2, lines 7-40 & Column 4, lines 10-39 & Column 5, lines 1-12 & Column 7, lines 5-22 & Column 8, lines 4-63 & Column 9, lines 1-68 & Column 10, lines 1-58 & Claim 4). Furthermore, the Office has indeed provided as to why one of ordinary skill in the art at the time of the invention would combine the teaching of the DiToro reference in the communication system as described in the AAPA so as to minimize the computational complexity of the equalization process over performing the equalization process in the time domain (Column 1, lines 60-68 & Column 2, lines 1-5). Furthermore, implementing the equalization process in the frequency domain is irrelevant to the type of communication channel (i.e. equalization for both or either type of communications channel can be performed in the frequency domain), which again is not claimed.

In regards to the specific argument that (Appeal Brief, Argument, Page 8, lines 1-3) "...it is only possible to arrive at the method of the present invention as defined by the independent claim 1 starting with the AAPA and in view of DiToro through the impermissible use of hindsight", this is incorrect. The Office has indeed provided as to why one of ordinary skill in the art at the time of the invention would combine the teaching of the DiToro reference in the communication system as described in the AAPA so as to minimize the computational complexity of the equalization process over performing the equalization process in the time domain and this is disclosed in the DiToro reference (Column 1, lines 60-68 & Column 2, lines 1-5), therefore there is no hindsight.

In regards to the specific argument presented that (Appeal Brief, Argument, Page 9, lines 2-6) "....even if the skilled person did for some reason become motivated to try applying the STC technique to DiToro, why he/she would then consider going against the teaching of DiToro by removing one of the essential elements (i.e. the inserted time gaps) of the system of DiToro in order to arrive at the present invention...", this is incorrect. The time gaps inserted in the DiToro reference are to minimize the effects of dispersion in the communication channel, however the equalization of the received data in the frequency domain instead of time domain as also disclosed in DiToro, to minimize the complexity (further disclosed in the reference), is irrelevant to the type of channel, thus the time gaps therefore would not need to be removed. Furthermore, as explained above a communication channel comprising both non-dispersive and dispersive interferences is dispersive,

therefore one of ordinary skill in the art would not need to remove the teaching of time gaps from the DiToro reference since this would be to remove the dispersive interferences and the teaching of the AAPA would remove the non-dispersive interferences.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

Sudhanshu C. Pathak

CHIEH M. FAN
SUPERVISORY PATENT EXAMINER

JAY K. PATEL
SUPERVISORY PATENT EXAMINER

Chieh M. Fan
(Appeal Conferee)

Jay Patel
(Appeal Conferee)